accompany it." I know very well what you mean. But only ask yourself what mental step you have made, and you will see you stand on words; more or less perfect and appropriate, true; but nevertheless, always words. You blame me for having ignored your labours, which were intended to show that the minds of everyone are not like one's own. You know that I took a great deal of interest in your researches. They represented to me what I should venture to call the dialectology of thought. But dialects of thought do not affect the fundamental principles of thinking; and the identity of language and reason can hardly be treated as a matter of idiosyncrasy.

You also blame me for not having read a recent book by Monsieur Binet. Dear Mr. Galton, as I grow older I find it the most difficult problem in the world, what new books we may safely leave unread. Think of the number of old books which it is not safe to leave unread; and yet, when I tell my friends that in order to speak the *lingua franca* of philosophy, they ought at least to read Kant, they shrug their shoulders, and say they have no time, or, *horribile dictu*, that Kant is obsolete. I have, however, ordered Binet, and shall hereafter quote him as an authority. But who is an authority in these days of anarchy? I quoted the two greatest authorities in Germany and England in support of my statement that the genealogical descent of man from any other known animal was as yet *unproven*, and I am told by my reviewer in the *Academy* that such statements "deserve to be passed over in respectful silence." If such descent were proved, it would make no difference whatever to the science of thought. Man would remain to me what he always has been, the perfect animal; the animal would remain the stunted man. But why waste our thoughts on things that may be or may not be? One fact remains, animals have no language. If, then, man cannot think, or, better, cannot reason, without language, I think we are right in contending that animals do not reason as man reasons;—though, for all we know, they may be all the better for it.

Yours very truly,
F. MAX MÜLLER.

Francis Galton, Esq., F.R.S.

42 *Rutland Gate, S.W., May* 18, 1887.

DEAR PROFESSOR,—Thank you much for your full letter. I have not yet sent it on to NATURE because it would have been too late for this week's issue, and more especially because I thought you might like to reserve your reply, not only until you had seen my own answer to what you have said in it, but also until others should have written, and possibly also until you had looked at Binet, and some of the writers he quotes. So I send you very briefly my answer, but the letter shall go to NATURE if you send me a post-card to send it.

In my reply, or in any future amplification of what is already written, I should emphasize what was said about fencing, &c., "*with the head*," distinguishing it from intuitive actions (due, as I and others hold, to inherited or personal habit).

The inhibition of words in the cases mentioned was, I should explain, analogous to this:—There are streets improvements in progress hereabouts. I set myself to think, by mental picture only, whether the pulling down of a certain tobacconist's shop (*i.e.* its *subtraction* from the row of houses in which it stands) would afford a good opening for a needed thoroughfare. Now, on first perceiving the image, it was associated with a mental perception of the *smell* of the shop. I inhibited that mental smell because it had nothing to do with what I wanted to think out. So words often arise in my own mind merely through association with what I am thinking about; they are *not* the things that my mind is dealing with; they are superfluous and they are embarrassments, so I inhibit them.

I have not yet inquired, but will do so, whether deaf-mutes who had never learnt words or any symbols for them, had ever been taught dominoes, or possibly even chess. I myself cannot conceive that the names—king, queen, &c.—are of any help in calculating a single move in advance. For the effect of many moves I use them mentally to record the steps gained, but for nothing else. I have reason to believe that not a few first-rate chess-players calculate by their mental eye only.

In speaking of modern mental literature, pray do not think me so conceited as to refer to my own writings only. I value modern above ancient literature on this subject, even if the modern writers are far smaller men than the older ones, because they have two engines of research which the others wanted:—

(1) Inductive inquiry, ethnological and other. The older authorities had no vivid conception of the different qualities of men's minds. They thought that a careful examination of their own minds sufficed for laying down laws that were generally applicable to humanity.

(2) They had no adequate notion of the importance of mental pathology. When by a blow, or by a disease, or, as they now say, by hypnotism, a whole province of mental faculties can be abolished, and the working of what remains can be carefully studied, it is now found that as good a clue to the anatomy of the mind may be obtained as men who study mangled limbs, or who systematically dissect, may obtain of the anatomy of the body.

I add nothing about the advantage to modern inquirers due to their possession of Darwinian facts and theories, because we do not rate them in the same way.

Very truly yours,
FRANCIS GALTON.

Professor Max Müller.

Oxford, May 19, 1887.

MY DEAR MR. GALTON,—If you think my letter worth publishing in NATURE, I have no objection, though it contains no more than what anybody may read in my "Science of Thought."

Nothing proves to my mind the dependence of thought on language so much as the difficulty we have in making others understand our thoughts by means of words. Take the instance you mention of a shop being pulled down in your street, and suggesting to you the desirability of opening a new street. There are races, or, at all events, there have been, who had no name or concept of shop. Still, if they saw your shop, they would call it a *house*, a *building*, a *cave*, a *hole*, or, as you suggest, a chamber of smells and horrors, but at all events a *thing*. Now, all these are names. Even "*thing*" is a name. Take away these names, and all definite thought goes; take away the name *thing*, and thought goes altogether. When I say word, I do not mean *flatus vocis*, I always mean word as inseparable from concept, thought-word or word-thought.

It is quite possible that you may *teach* deaf-and-dumb people dominoes; but deaf-and-dumb people, left to themselves, do not invent dominoes, and that makes a great difference. Even so simple a game as dominoes, would be impossible without names and their underlying concepts. Dominoes are not mere blocks of wood; they signify something. This becomes much clearer in chess. You cannot move king, or queen, or knight as mere dolls. In chess, each one of these figures can be moved according to its name and concept only. Otherwise chess would be a chaotic scramble, not an intelligent game. If you once see what I mean by names, namely that by which a thing becomes *notum* or known, I expect you will say, "Of course we all admit that without a name we cannot really know anything."

I wonder you do not see that in all my writings I have been an evolutionist or Darwinian *pur sang*. What is language but a constant becoming? What is thought but an *Ewiges Werden?*

Everything in language begins by a personal habit, and then becomes inherited; but what we students of language try to discover is the first beginning of each personal habit, the origin of every thought, and the origin of every word. For that purpose ethnological researches are of the highest importance to us, and you will find that Kant, the cleverest dissector of abstract thought, was at the same time the most careful student of ethnology, the most accurate observer of concrete thought in its endless variety. With all my admiration for modern writers, I am in this sense also a Darwinian that I prefer the rudimentary stages of philosophic thought to its later developments, not to say its decadence. I have learnt more from Plato than from Comte. But I have ordered Binet all the same, and when I have read him I shall tell you what I think of him.

Yours very truly,
F. MAX MÜLLER.

A Use of Flowers by Birds.

SOME years ago you allowed me to describe in NATURE the pretty doings of a pair of goldfinches, who, having built their nest on a bough overhanging a garden path, proceeded to make it more like the sky above, and therefore less visible from below, by hanging it round with wreaths of forget-me-nots.

This year, in the same garden, some sparrows have shown equal ingenuity. They began a nest in a *Pyrus japonica* against

©1887 Nature Publishing Group

the white house, whilst the tree was still almost bare of leaves. Not wishing for the noise and dirt so near the windows, I removed it, and they began another; again it was removed, and this time, though apparently little more than a flat beginning, it had eggs upon it. They tried again, and on removing it the third time I found that the birds were overlaying it on all sides with the flowers of some sweet Alyssum that was growing below; the intention being, evidently, to render it more like the background of white wall, and therefore less conspicuous.

Sidmouth. J. M. H.

Earthquakes and the Suspended Magnet.

DURING the afternoon of May 3 at Lyons, N.Y., a peculiar quivering motion of the suspended magnet was noted, especially at about 1 o'clock p.m., and a strong westward deflection continued during the afternoon. Similar phenomena have been noted repeatedly when earthquakes were in progress, in this case the shock being quite severe, and occurring at 3.8 p.m. at El Paso, Texas. M. A. VEEDER.

Lyons, N.Y., May 4

Units of Weight, Mass, and Force.

THE letter of Prof. Greenhill (NATURE, vol. xxxv. p. 486) is both timely and suggestive. Herbert Spencer's chapter on space, time, matter, motion, and force, supplemented by his chapter on the persistence of force, in "First Principles of Philosophy," gives all that can be desired by the student for a complete comprehension of the subject. One who assimilates the basic truths there so clearly given need never be perplexed by any statement found in the mechanical and mathematical text-books. It is simply impossible to use language in regard to these matters without employing expressions that are true only in a certain sense. We say that "the sun rises" and "the sun sets," and that "the heavens revolve." If these words are used to indicate the cause of the progressive shadows on a sun-dial, or the time of day, they serve a practical need as well as if they were true. But a student who should infer the constitution of the solar system from such phrases would go far astray.

When the significance of Spencer's explanation of motion is grasped, a great part of the ambiguity will have vanished. We constantly think of motion as an entity, which is a pure delusion. We also say of force that it is the cause of motion. Nothing can be more untrue. Force is the cause of change of motion only There is not a conceivable difference between rest and motion otherwise than as the expression of a relation. Whether a body be at rest or in motion depends wholly upon the body to which it is related.

When the student sees that motion is no entity, and is familiar with the process by which the conceptions of matter, force, space, and time, are built up from sensations, he will be in no danger of mistaking the sense in which certain text-book statements are to be taken, much less will he be captured by those in which the errors are unpardonable. I. LANCASTER.

Chicago, Ill., April 28.

WITH regard to Mr. Geoghegan's letter in your issue of April 7 (vol. xxxv. p. 534), my experience in teaching physics long ago led me to the same conclusions. For three years I have used in my classes in this the oldest existing University in Ontario, and with the greatest advantage, the terms *tach, gramtach, prem*, and *dyntach* for the units of velocity, momentum, pressure-intensity, and rate of working respectively, in the C.G.S. system of units. These may be found in my "Introduction to Dynamics," which was printed last year for my junior class. *Prem* was chosen after failure to get a euphonious monosyllable from the Greek. A name for the unit of acceleration I have not found to be necessary. *Vel* seems to me to be a good word for the unit of velocity in the F.P.S. system of units, but, for fear of hanging on a sour apple-tree, I would shudder to mention *pound-vel* and *poundal-vel*. The term *squeeze* would be suitable in several respects for a *poundal per square foot*, but in mixed classes, such as we have here, it might lead to disorder.

D. H. MARSHALL.

Queen's University, Kingston, Ontario, Canada, April 27.

Remarkable Phenomenon seen on April 26, 1887.

A PHENOMENON was seen here this evening quite distinct from anything I have before observed. It was an exact copy of streams of aurora borealis rising from a low arch, but instead of being in the northern heavens it was near the south horizon. The sky was cloudless, except a long thundercloud which extended from near south-south-west to almost south-south-east, the upper portion of this cloud being about 12° above the horizon. From this cloud issued from one to three streams of conspicuous white light, the north-easterly stream being the largest and brightest, and this continued visible from 9.40 until 10.5 (the others were only seen for five minutes). The streams were at an angle of about 53°, and moved slowly easterly (the cloud moving in the same direction). The longest stream reached an altitude of 25°, and at 10 o'clock exactly (G.M.T.) the base was immediately over the Avonmouth Lighthouse. The light of the streams was more persistent and less flickering than is usually the case with aurora borealis.

There was also a confused luminosity behind the cloud, which varied considerably in brightness; this made the outline of the cloud at one time distinctly visible, and at another scarcely discernible; this also gave the clouds a black appearance. After 10 p.m. other clouds rose above the cumulo-stratus, and the streams became hid. Three hours afterwards there was a snow-storm, and the ground was white till 7 a.m. Reports from Somerset, Dorset, and Devon would be valuable.

Shirenewton Hall, near Chepstow. E. J. LOWE.

Pear-shaped Hailstones.

ARE pear-shaped hailstones as uncommon as some of your correspondents suppose?

We have had here to-day a succession of heavy showers of rain and hail together, the hailstones being small, but many of them pear-shaped, and the rest of shapes which might easily have been derived from that form by attrition or partial melting.

About half past six this evening we had a storm of hail only, heavier than any that preceded it, in which nearly or quite all the stones were pear-shaped, from a fifth to a third of an inch in diameter. B. WOODD SMITH.

Penmaenmawr, N. Wales, May 20.

P.S.—May 21. At 9.30 this morning we had another shower of hail and rain, in which the stones showed no sign of any pear-shape, but were of irregular rounded forms.

"A Junior Course of Practical Zoology."

IN the review of Messrs. Marshall and Hurst's book referred to in my friend Prof. Bourne's letter, I sought to compare that work with others devoted to the familiar type-system, to which alone the words "all other books current" were meant by me to refer, to the exclusion of general text-books such as those from which he quotes. I admit that I might have made my meaning somewhat plainer than I did, and would beg to be allowed to state that I had it in my mind, at the time of writing, to refer the reader to the impartial statements made on the subject in question by Prof. Rolleston in his "Forms of Animal Life"; the first of the series of what we are now pleased to term "type" or "junior course" books.

With respect to my critic's second objection, I would ask the readers of NATURE to judge for themselves how far the quotations which he so skilfully weaves into his letter do justice to my contention. His view is, like my own, but an expression of opinion, and time alone can show which of the two will come nearest the truth. G. B. H.

South Kensington.

Bishop's Ring.

THE letter by Prof. G. H. Stone in NATURE, vol. xxxv. p. 581, is interesting, as showing the disappearance of "Bishop's ring" in Colorado. It has not wholly disappeared here, being still plainly visible about sunset. In the middle of the day, however, I have rarely seen any trace of its red colour since May last year; but up to that time, although growing much fainter, it was still frequently plain here, and I also saw it in the south of England, both in May and June 1886, but only feebly. Since then, when there has been a slight tinge of red, it has usually

©1887 Nature Publishing Group